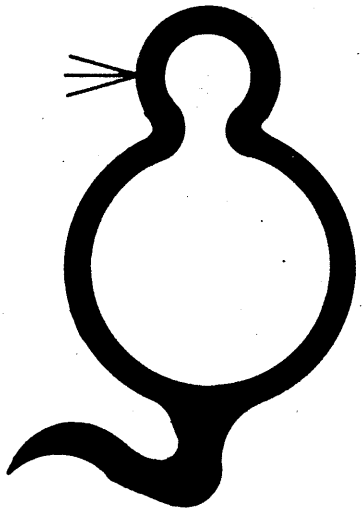
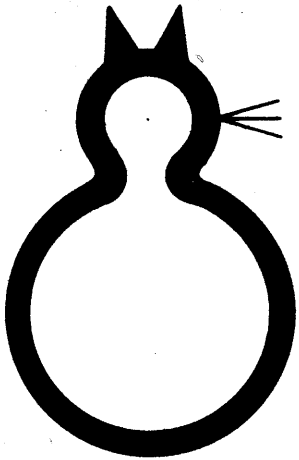




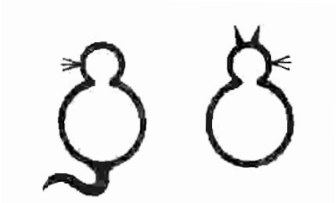
Stereogram exercises

Information and advice for patients

Orthoptics

What are stereogram exercises?

Stereogram exercises are exercises for your eyes that can help to improve the symptoms of convergence insufficiency. A stereogram is 2 incomplete images which can be joined into 1 complete image and vice versa. Your orthoptist will explain and demonstrate this exercise for you.



How to do the exercise

1. Hold the cat card at arm's length at the same level as your eye.
2. Then hold a pen half way between the card and your face.
3. Look at the top of the pen and concentrate on it. It should appear as a single image.
4. The cats behind the pen will then look like they are moving apart. The aim is for you to be able to see 3 cats behind the pen while still looking at the pen.
5. The 3 cats should look like this:

The middle cat should be complete. When you first start doing this exercise the middle cat might appear blurred, but if you keep doing this exercise the cat should become clear.

If you become very good at this exercise, you may be asked to do the exercise without using the pen. This means you will need to look at an imaginary point in front of the cat so you can see the complete cat.

After doing the exercises it is important that you relax your eyes by looking into the distance or by closing them for a minute or so. When you start this exercise you may feel increased eye strain and get headaches but try not to be put off.

Stereogram exercises

Information and advice for patients

Orthoptics

How often should I do the exercises?

These exercises should only be done for a few minutes at a time, but frequently throughout the day. The orthoptist will tell you how many weeks you should perform the exercises for as this can vary.

Other stereogram cards you might be given

Bucket: You do this in the same way as the cat stereogram, but the aim is for you to see the middle bucket as a 3D image, as if you are looking into the bucket.

ABC rings: This is another stereogram card, with a different image. Your orthoptist will demonstrate how to do this.

Further information

If you have any questions or concerns please contact your orthoptist for advice on 0121 507 3202

For more information about convergence insufficiency please see our 'Convergence Insufficiency' leaflet.

For more information about our hospitals and services please see:
www.swbh.nhs.uk

Sources used for the information in this leaflet

- 'Clinical Orthoptics', Fiona J. Rowe, 1997
- 'Diagnosis and management of ocular motility disorders', Alec Ansons and Helen Davis, 1986

If you would like to suggest any amendments or improvements to this leaflet please contact the communications department on 0121 507 5420 or email: **swb-tr.swbh-gm-patient-information@nhs.net**

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Pregled
Review

STRABIZMI DJEČJE DOBI

VENERA LAKOŠ-KRŽELJ*

Strabizam ili tropija je naziv za neparalelnost vidnih osi. Strabizmi mogu biti paralitički (pojavljuju se u svakoj životnoj dobi) i neparalitički ili konkomitantni strabizmi čija je osobitost da se javljaju u dječjoj dobi, i nalaze se u 5-6% sveukupne populacije. Strabizmi su i motorni i senzorni poremećaji jer se javljaju u doba razvoja vida kad su retinokortikalni adaptacijski mehanizmi elastični i sposobni za obranu od diplopije i konfuzije nastalih motornom anomalijom. Liječenje je dugotrajno i sastoji se od pleoptičkih metoda (okluzije, vježbe) kojima se liječi slabovidnost i druge senzorne komplikacije, te od ortoptičkih metoda (naočale, okluzije, prizme) koje uspostavljaju i zadržavaju paralelnost vidnih osi. Jedan od koraka u liječenju strabizma su operacije na očnim mišićima. Opetovanim nadzornim pregledima treba pratiti liječenje poremećenog razvoja vidnih funkcija u anomalnim senzorno-motornim uvjetima kakvi se nalaze u strabizmima dječje dobi. Treba mijenjati i uvoditi nove metode primjerene dobi djeteta i etapi do koje se napredovalo u liječenju.

Deskriptori: KONKOMITANTNI STRABIZAM, ESOTROPIJA, EXOTROPIJA, AMBLIOPIJA

Razrokost ili strabizam ili tropija je naziv za motorno-senzorne anomalije u kojih je dominantna i uočljiva neparalelnost vidnih osi (1). Strabizmi se dijele na paralitičke ili nonkomitantne i neparalitičke ili konkomitantne. Paralitički strabizmi se pojavljuju u svakoj životnoj dobi, dok konkomitantni počinju uvijek u dječjoj dobi i nalaze se u 5-6% sveukupne populacije (1-4) (Slika 1 i Slika 2). Osobitosti konkomitantnog strabizma su uredna anatomska građa i od limbusa adekvatno udaljena hvatišta vanjskih očnih mišića ili bulbomotora i njihova pokretljivost. Poremećen je međusobni sklad agonista, antagonista i sinergista na oba oka što čini otklon jednog ili oba oka (1, 2, 4) (Slika 3).

Kratka neurofiziološka saznanja

Tri para bulbomotora pokreću očnu jabučicu a njih inerviraju tri moždana živca: N. oculomotorius, N. trochlearis i N. abducens (5). Osobitost očnih pokreta jest da su *konjugirani* ili "ujarmljeni" tako da se oba oka pokreću usklađeno u istom smjeru i jednakom brzinom tijekom voljnih i refleksnih pokreta (1, 2, 6). Prema Heringovom pravilu odgovarajući mišići primaju istu količinu ekscitacije pa imaju i isti stupanj kontrakcije (1, 2). Očnim pokretima upravljaju brojne moždane strukture tako da pet neuralnih sustava omogućuje pet vrsta očnih pokreta: vestibulo-okularni refleks ili VOR, i optokinetički refleksi ili OKR su pokreti što stabiliziraju oči tijekom pokretanja glave i evolucijski su najstariji. Ostale vrste očnih pokreta su sakade, zatim glatki pokreti praćenja i vergencije. To su pokreti koji održavaju sliku predmeta na foveji centralis (5).

Motoričke jedinice očnih mišića su gotovo sve FF (engl. fast fatigable) jedinice, tj. bijeli mišići s brzim kontrakcijama i relaksacijama, ali i brzim zamaranjem tijekom ponavljanog podražaja (5). Položaj i brzina kretanja bulbusa kodirani su aktivnošću očnih motoneurona moždanog debla (5).

U skladnosti i konjugiranosti očnih pokreta sudjeluju neuroni područja ponsa: retikularni neuroni paramedijalne pontine retikularne formacije (PPRF); zatim Fasciculus longitudinalis medialis (FLM). Zapravo, silazna vlakna FLM dolaze iz jezgara kao što su nucleus interstitialis Cajal, zatim iz gornjih kolikula i iz retikularne formacije ponsa (PPRF). Uzlazna vlakna FLM su većinom aksoni vestibularnih jezgara koji sinaptički završavaju na okulomotornim jezgrama III, IV, i VI kranijalnog živca i u intersticijalnoj Cajalovoj jezgri.

Ključnu ulogu u konjugiranim vodoravnim pokretima očiju imaju aksoni internuklearnih interneurona jezgre N. abducensa koji križaju stranu i kroz suprotni FLM ulaze do onog dijela jezgre N. oculomotoriusa koja inervira musculus rectus medialis (5). Judaš i Kostović naglašavaju važnost uzlaznih aksona FLM koji su veza između vestibularnih i okulomotornih jezgara, ali i između pojedinih okulomotronih jezgara.

Oštećenja i neurofiziološke anomalije u tom području, uzrok su nastanku motornih ispada, tj. horizontalnom strabizmu. Tu je još važna i aktivnost Nucleus praepositus hypoglossi (NPH) a smještena je u produljenoj moždini tik uz FLM. Njeni aksoni gusto odlaze na suprotnu jezgru

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Slika 1.
Strabizam može biti nasljedni: troje od petoro ezotropne djece iz jedne osmočlane obitelji.

Figure 1
Strabismus is hereditary disease: three of five children from eight members family.

N. abducensa i istostranu jezgru N. oculomotorisa, dakle sudjeluje u ravnanju horizontalnim očnim pokretima (5).

Osim Cajalove jezgre čiji aksoni silaze kroz FLM (tractus interstitiospinalis) i inerviraju većinu motoneurona suprotne jezgre N. oculomotoriusa i obje jezgre N. trochlearisa, značajna je jezgra smještena u najkaudalnijem dijelu subtalamusa, između vlakana rostralnog kraja FLM. To je rostralna intersticijska jezgra FLM ili *riFLM* i generator je okomitih sakada. Povezana je s istostranom jezgrom N. oculomotoriusa

Slika 3.
Alternirajuća esencijalna ezotropia.

Figure 3
Esotropia essentialis alternans.

pa inervira motoneurone mišića koji odižu i spuštaju očnu jabučicu, dakle ima udjela u okomitim očnim pokretima.

Gornji kolikuli se sastoje od površinskih slojeva koji imaju vidne, i od dubokih koji imaju motorne funkcije. Površinski slojevi sadrže retinotopnu mapu suprotne homonimne polovice vidnog polja a uzlazne projekcije šalju u pulvinar koji završava u poljima 18 i 19. Gornji kolikuli i pulvinar dio su *ekstragenikulatnog vidnog sustava* (5). Glavni vidni sustav je retino- genikulo-strijatni koji se projicira u polju 17 ili areji V_1 i omogućava razvoj dobre vidne oštrine. Naziva se još i genikulatni vid. Ako se on ne razvije i preostane ovaj ekstragenikulatni preko gornjih kolikula, čovjeku preostane teška slabovidnost ili kolikularni vid.

Ad 4) Glatki pokreti praćenja održavaju sliku pokretnog predmeta na mjestu najoštrijeg vida, a njima združeno upravljaju korteks, mali mozak i moždano deblo.

Ad 5) Pokrete vergencije i s njima akomodaciju leće i sužavanje zjenice nadziru neuroni smješteni u tegmentumu mezencefalona u blizini jezgre N. oculomotoriusa. Retinalni disparitet je razlika položaja slike gledanog predmeta u dvije mrežnice. Mali retinalni dispariteti od svega 15 lučnih sekundi (15 arc sec) su dovoljan podražaj za stereoskopski vid. Retinalni dispariteti od nekoliko lučnih minuta izazvat će i pokrete vergencije. Ako se radi o izostanku ili pretjeranoj aktivnosti vergencija, imamo kliničku sliku ekscesne intermitentne exotropije ili slabe ili pojačane konvergencije (povećan odnos akomodacijske konvergencije prema potrebnoj akomodaciji) (5-8).

Podjela strabizama

Postoji više podjela strabizama. Prema intenzitetu motornog poremećaja strabizmi mogu biti manifestni ili latentni. *Heterotropija* ili manifestni strabizam ima uočljiv otklon jednog ili oba oka. Nije moguće istodobno obje vidne osi usmjeriti prema fiksacijskom objektu. Pritom u otklonu može biti uvijek samo jedno oko (monolateralni) ili je u otklonu čas jedno, čas drugo oko (alternirajući).

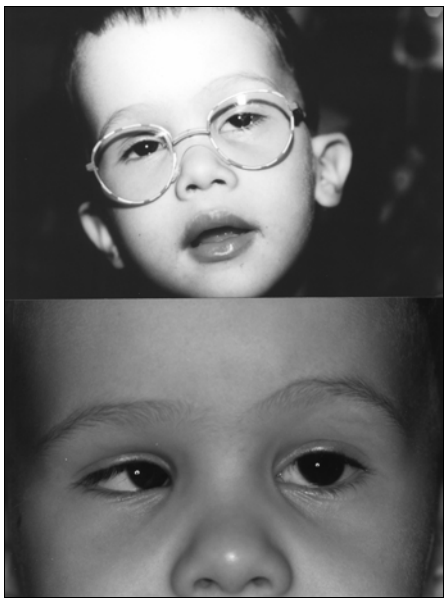
Slika 2.
Monokularna ezotropija desnog oka.

Figure 2
Right monocular esotropia

Heteroforija ili latentni strabizam ima prikriveni, povremeni otklon koji se pojavljuje u određenim nepovoljnim okolnostima, tj. u trenutku kad se isključi fuzija (1, 7-9).

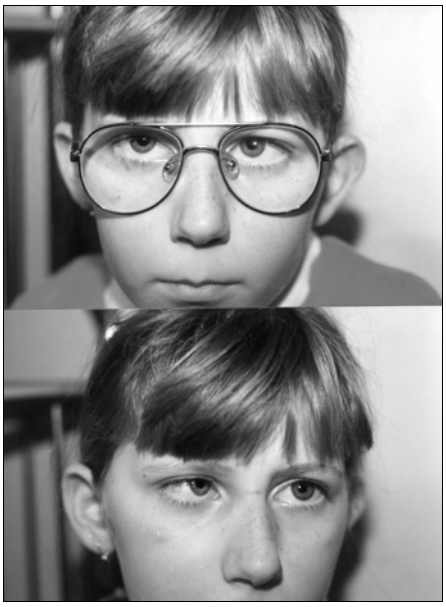
Podjela tropija prema smjeru otklona: horizontalni i vertikalni. Čisti vertikalni otkloni su rijetki i češće su kombinirani s najčešćim, horizontalnim strabizmima (1). Najčešći su horizontalni strabizmi. Njih dijelimo na konvergentne strabizme ili *esotropije* i divergentne strabizme ili *exotropije* (1-4, 7-10).

Esotropije ili konvergentni



Slika 4.
Isto ezotropno dijete snimljeno u dobi od 9 mjeseci i u dobi od 4 godine nakon operacije.

Figure 4
The same child with infantile esotropia before surgery in the 9 month age and after surgery in the 4 years age.



Slika 5.
Akomodacijska ezotropija bez naočala. Nošenjem naočala kut razrokosti se smanjuje

Figure 5
Esotropia accommodativa without glasses. The angle of the deviation is decreased with glasses

strabizmi su najčešći, oko 80%. Postoje različite podjele koje uzimaju u obzir vrijeme nastanka i udio refrakcijske greške. U našoj zemlji koristimo podjelu koju je napravio švicarski strabolog Prof. Lang.

Podjela esotropija po Langu

- Rane konatalne esencijalne esotropije nastale od rođenja do prve godine života (Slika 4.) (3, 4 8).
- Stečene esotropije a) rane, nastale u doba senzornog oblikovanja u dobi od 1 do 3 godine i b) kasne, normosenzoričke, nastale u dobi od 3 do 7 godina.
- Akomodacijske esotropije (Slika 5.) su one koje su uzrokovane hipermetropijom ili dalekovidnošću većom od +2,0 Dsf i koje se potpuno ili djelomično popravljaju za vrijeme nošenja odgovarajućih naočala: a) čisto akomodacijske, b) djelomično akomodacijske i c) esotropije s povećanom akomodacijskom konvergencijom. Bitna osobitost ove grupe esotropija je njihovo održavanje odnosno liječenje naočalama sa što većom hipermetropskom korekcijom, uključujući tu i bifokalne i multifokalne naočale (1, 7, 10). Treba biti vrlo oprezan i kritičan pri odluci za operacijsko liječenje, u odnosu na prethodne grupe esotropija (11).
- Mikrostrabizmi ili mikrotropije su esotropije s manjim otklonom, ali s monokularnom ambliopijom i poremećenim senzornim odnosima.
- Rijetki oblici esotropija: periodičke esotropije, strabismus fixus itd.
- Atipični oblici strabizma su rjeđi i ne mogu se potpuno korigirati operacijskim metodama.

Slika 7.
Exotropia s ekscesnom divergencijom.

Figure 7
Exotropia with excessus divergentiae.

Exotropije ili divergentni strabizmi (Slika 6.) pojavljuju se u oko 20% strabičke djece. Vidne osi divergiraju. Općenito se može reći da se pojavljuje kasnije, kad je monokularni vid već razvijen, a binokularna suradnja relativno učvršćena pa rjeđe nalazimo ambliopiju (1-4, 9, 12).

Već dugo vrijedi podjela exotropija prema Duanu i Burianu.

- Insuficijencija konvergencije nalazi se većinom u kratkovidnih osoba - miopa jer zbog miopije takve osobe nemaju potrebu za akomodacijom a konvergencija je otežana. Liječenje se sastoji u nošenju naočala s adekvatnom korekcijom i prizmama, a u nekim slučajevima potrebna je operacija.
- Ekscesna divergencija uzrokuje povremenu exotropiju s kutom razrokosti koji se povećava gledanjem u daljinu (1, 12). Najčešće je tropija alternirajuća, s dobrim vidom obostrano. Binokularni vid je često uredan ili postoji dvojna korespondencija. Redovito se mora operacijski korigirati.
- Bazička exodevijacija (Sl. 7.)

Slika 6.
Alternirajuća exotropija.

Figure 6
Exotropia alternans.

Slika 8.
Čitanje brojeva s optotipa po Snellenu. Torticollis i dextroverzija se pojačavaju pri gledanju sve manjih brojeva..

Figure 8
Visual acuity testing on Snellen optotypes. Torticollis and dextroversion are increased when the child is required to look at smaller and smaller numbers.

Slika 9.
Ispitivanje vida pomoću probnih naočala kod djevojčice u dobi od 2 godine.

Figure 9
Visual acuity testing with probbing frame spectacles.

obilježena je stalnim, velikim kutom razrokosti i ambliopijom. Liječenje redovito kirurško uz pleoptičko liječenje ambliopije (1, 3).

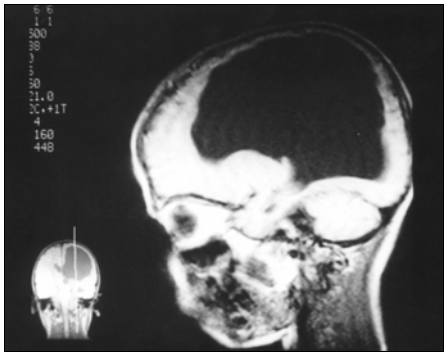
DIJAGNOSTIKA STRABIZMA

- Anamneza
- Inspekcija: (Slika 8.) krivi položaj glave, tortikolis, nepravilnosti građe lica, epicanthus (1-4, 13).
- Cover test (test pokrivanja): alternirajući, cover- uncover i alternirajući uz prizme. Ovo je bazični i vrlo vrijedan test kojim se može ustanoviti ima li uopće razrokosti, može se razlučiti postoji li latentna tropija ili heteroforija, koja je vrsta razrokosti, postoji li ambliopija (1-4, 13).
- Ispitivanje motiliteta: verzije, dukcije i vergencije. Preporučena udaljenost fiksirajućeg objekta (prst ispitivača, kemijska olovka u ruci, ili igračka i sl.) treba biti 40 do 60 cm ispred djeteta. Ispitivanje konvergencije radi se pomoću igračke u ruci sa udaljenosti od oko 50 cm ispred djeteta s približavanjem do oko 2 cm pred nosićem. Motorni akt konvergencije prati akt akomodacije i mioze, to je optomotorni refleks koji omogućava gledanje na blizinu.
- Cjeloviti oftalmološki pregled prozirnih očnih tkiva od rožnice preko leće do staklovine i fundusa da se isključe druge očne bolesti.
- Određivanje fiksacije pri pregledu fundusa i visuskopom pomoću test sličica (zvjezdica, kružići i sl.) koji su projicirani na dječju mrežnicu. Fiksaciju možemo ocijeniti od drugog mjeseca života (1-4, 13).
- Ispitivanje vidne oštrine (Slika 9.) je subjektivna metoda i apsolutno zavisi o dobi djeteta. U prvoj i drugoj godini života razvoj vida procjenjuje se (indirektno) ispitivanjem fiksacije i cover testom. Od druge godine poneko dijete možemo privoliti na "čitanje" sličica na udaljenosti za čitanje (oko 30 cm), zatim na oko 1-2 m. Od treće godine života većina djece može "čitati" sličice na udaljenosti od 3 m. U kasnijoj dobi ispitivanje vidne oštrine vrši se Pflugerovim E-slovima okrenutim u 4 položaja koje asociraju djecu na ispruženu ručicu okrenutu u položaju gore, dolje, desno ili lijevo. U prvim pregledima može se ispitivati na udaljenosti od 2 ili 3 m, zatim i na 6 m. (Slika 8.) U kasnijoj dobi vidna oštrina ispituje se na optotipima s brojevima ili slovima (Snellen) (1-4, 13).
- Skijaskopija (retinoscopy) je objektivni pregled refrakcije oka. Ukapavanjem atropina (0,5% ili 1,0%) ili drugih, blažih cikloplegika, vršimo dilataciju zjenice ali i cikloplegiju, tj. paraliziramo Musc. ciliaris koji prstenasto okružuje leću i radijarno je rasteže u mirnom stanju, a ispupčava je prilikom akomodacije i tako pojačava njenu lomnost (1-4, 13).
- Automatski refraktometar je kompjutorizirani mjerač refrakcije oka. U dječjoj dobi je vrijedna refraktometrija pri cikloplegiji i to je zapravo automatski dobivena skijaskopija (4).
- Mjerenje objektivnog kuta razrokosti
  - Orijentacijsko mjerenje prema refleksu rožnice
  - Maddox križ i Maddox križ s prizmama (Krimsky test)
  - Egzaktno mjerenje: a) na sinotoforu, b) pomoću prizama u slobodnom prostoru (1, 4).
- Određivanje binokularnog vida: a) sinoptofor, b) u prostoru (Bagolini prugasta stakla).
- Ispitivanje stereovida: a) na sinoptoforu i b) pomoću polarizacijskih testova na udaljenosti za čitanje (TNO stereo-test i Titmus test).
- PAT ili Test prizmatske adaptacije kod starijih od 12 godina kako bismo isključili poslijeoperacijske dvoslike (1, 4).
- Pregled neuropedijatra, VEP, CT i MRi (Slika 10.) i druga dijagnostika radi diferencijalne dijagnostike i u slučajevima atipičnih strabizama.

KOMPLIKACIJE STRABIZMA

Komplikacije strabizma su senzorni poremećaji

Dvoslike i konfuzija: motorni poremaćaj uzrokovao je anatomske promjene tako da se korespodentne točke mrežnice više ne podudaraju. Nastaju dvoslike i konfuzije jer se dvije slike nastale na mrežnici dva oka u



Slika 10.
Kompjutorizirana tomografija mozga djeteta s ezotropijom i nistagmusom: Kongenitalna cista mozga.

Figure 10
Computorised tomography of the brain in a child with esotropia and nystagmus. CT showed congenital cystis of the brain caused by PVL (Leukomalacia periventricularis).

Slika 11.
Okluzija oba oka sa stenopeičnim otvorima kod slabovidnog ezotropa s nistagmusom.

Figure 11
Adhesive eye patches of both eyes with stenopeic holes.

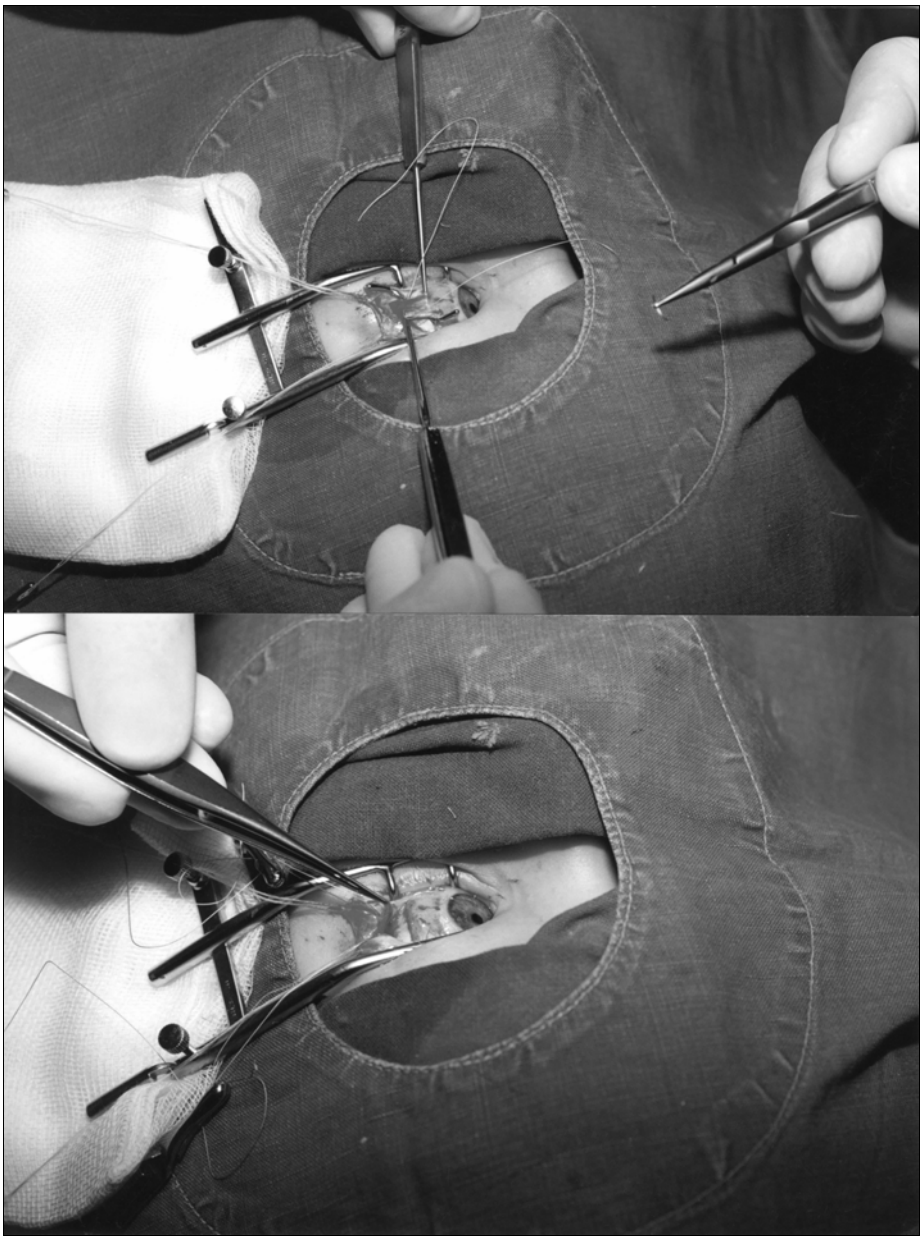
strabizmu ne mogu više senzorno ujediniti (1-3). Dvoslike su nepodnošljivo stanje. Izlaz je u prilagodbi na anormalno stanje pa nastaju anormalni senzorni odnosi. To je moguće, za razliku od strabizma nastalog u odraslih, jer je razvoj vida i razvoj kvaliteta binokularnog vida još u tijeku. To razdoblje je nazvano *senzitivni period* i traje do oko devete godine života (1, 2, 4).

Razdoblje dvoslika u dječjoj dobi traje kratko, jer nastupaju kompenzatorni mehanizmi obrane od dvoslika. Fenomen centralne supresije je kortikalno potiskivanje slike strabirajućeg oka čija je posljedica stvaranje skotoma na mrežnici: jedan skotom nastaje u novom središtu mrežnice kamo pada slika u novom položaju oka. U ezotropiji to je nazalno od foveje centralis. Drugi skotom stvara se baš u foveji centralis kako bi se otklonila konfuzija. Ta dva skotoma mogu se i spojiti. Otklanjanjem dvoslike strabirajuće oko biva isključeno iz vidne funkcije a produžavanjem takvog stanja ti odnosi se učvršćuju pa dolazi do smanjenja vidnih funkcija, tj. pada vidne oštrine ili ambliopije (1, 2, 4).

Ambliopija ili slabovidnost je smanjena vidna oštrina za najmanje dvije desetine od vidne oštrine parnog oka, a koja se ne može poboljšati optimalnom optičkom korekcijom. Pregledom oka i funduskopijom dobije se normalan nalaz. Osim strabizmičke, u djetinjstvu nastaju refrakcijske (anizometropne), deprivacijske i ambliopije udružene s nistagmusom (1, 2, 4, 6, 7, 10). U liječenju strabizmičke ambliopije nailazimo i na druge vrste ambliopije, napr. anizometropsku ili refrakcijsku. Noorden je zato zaključio da je uzročnost ambliopije i strabizma dvosmjerna (7, 10). Međutim, u slučaju strabizmičke ambliopije važna je njezina ozbiljnost:

- A. gravis s vidnom oštrinom (VO) manjom od 0,1
- A. media s VO 0,1 do 0,3
- A. laevis s VO 0,4 do 0,7.

Ekscentrična fiksacija je teška senzorna komplikacija strabizma kad foveja centralis strabirajućeg oka izgubi funkciju fiksacije jer je neko ekscentrično mjesto (areal) mrežnice preuzelo funkciju gledanja "ravno naprijed". Kako sva ekscentrična mjesta mrežnice imaju daleko manju gustoću



Slika 12.
Operacija: Ressectio Musc. Recti Lateralis desnog oka: A) prikaz mišića i postavljenje šavova na oko 6 mm; B) mišić, Musc. Rect. Lateralis odrezan od prvobitnog hvatišta.

Figure 12
Strabismus surgery: Rectus Lateralis Muscle resection of the right eye: A) the muscle is properly exposed and the sutures are placed approximately 6 mm from the tendinous insertion. B) the muscle, Musc. Rect. Lateralis, is cut from the globe

čunjića od foveje centralis, jasno je da takvo oko ima tešku ambliopiju (1, 4, 8).

Anomalna retinalna korespondencija (ARK), anomalna retinokortikalna (ARKK) korespondencija i dvojna RK. Normalna binokularna suradnja ili NRK ima za uvjet zajednički smjer vidnih osi obje foveje centralis. Sve mrežnične točke također imaju odgovarajući smjer i vidne potencijale koje diktiraju obje foveje centralis (1, 4, 8). Ali, stvarno ujedinjenje slika sa tih dviju mrežnica zbiva se na razini korteksa i to je NRKK ili normalna retinokortikalna korespondencija. ARKK je poremećaj binokularnog vida koji se u strabizmu poremeti u raznim oblicima: od potpunog nedostatka binokularnog vida do novostvorenih, krivih binokularnih odnosa koji su posljedica traženja najboljeg rješenja tijekom adaptacije na novonastali strabizam. U nekim slučajevima strabizma nailazimo na fenomen dvojne RK (intermitentna exotropia) (1, 2, 4, 12).

LIJEČENJE STRABIZMA

Liječenje strabizma nije brzo, a još manje spektakularno. Liječenje se provodi u razdoblju tzv. senzitivnog perioda: za strabizam i strabizmičku ambliopiju do oko devete godine života a za anizometrojiu i dulje: oko dvanaeste godine (1, 2, 4).

U načelu, liječenje se dijeli na konzervativno i kirurško. Osim veličine, smjera i nestalnosti motornog poremećaja, ponavljanim nadzornim pregledima treba razlučiti vrstu strabizma, tj. vrstu i opsežnost senzornih poremećaja (1, 2, 4, 7, 8).

Razumijevanje senzornih poremećaja diktira načine liječenja:

- Konzervativno liječenje zbiva se u dva smjera:
  - Pleoptičko (pleos= potpun) je zapravo liječenje ambliopije kako bi se poboljšala vidna oštrina, ali i uspostavila i učvrstila centralna fiksacija razrokog oka.
  - Ortoptičko (orto = ravno) liječenje treba uspostaviti i zadržati paralelan položaj očiju kako bi se normalizirali senzorni binokularni odnosi (9).
- Operacije na bulbomotorima dopunjavaju ortoptičko liječenje

Konzervativno liječenje

- Korekcija refrakcijske greške: naočale (Slika 5.) monofokalne, bi- i multifokalne i kontaktne leće (7)
- Okluzija (Slika 11.) ili zatvaranje jednog oka (totalna, sektorna, djelomična, povremena)
- Midrijaza vodećeg oka (atropin, homatropin, scopolamin)
- Penalizacija (zamagljivanje vodećeg oka pojačanom dioptrijom kako bi se koristilo slabovidno) (1, 4,7)
- Pleoptičke vježbe na aparatima (Bangerterov centrofor, Cuppersova eutiskopija, koordinator i separator po Cuppersu, vježbe na sinoptoforu: podraživanje foveole i vježbe fuzije; vježbe precrtavanja i druge vježbe ruka-oko).

Operacijsko liječenje

- Operacije na očnim mišićima:
  - ravni očni mišići: retropozicija-pomicanje od limbusa prema ekvatoru (Slika 12.); antepozicija -pomicanje prema limbusu; resekcija - skraćivanje mišića; elongacija Z-miotomijom - produljivanje mišića; transpozicija - pomicanje vodoravnih mišića u okomitom smjeru od bivšeg hvatišta i obrnuto (11, 14, 15).
  - kosi očni mišići: antepozicija donjeg kosog po Gobinu sa stražnjeg pola ispred ekvatora oka
- Botulinum A toxin (Oculinum).

Sve navedene vrste liječenja se ne isključuju, nego nadopunjuju. Treba napomenuti da se liječenje odvija u etapama-najprije optimalna optička korekcija i liječenje slabovidnosti okluzijom i ostalim metodama. Ako se zadovoljavajući izgled, tj. paralelnost vidnih osi može dobiti i održati bez operacije, kao u slučaju akomodacijske esotropije, onda je nepotrebno operirati. Operacijama na bulbomotorima poboljšavamo estetski izgled i položaj očne jabučice (Slika 4.) (11, 14). Međutim, stvorili smo nove motorne i anatomske uvjete koji mijenjaju prije uspostavljene senzorne. Zato je u poslijeoperacijskom razdoblju ponovno važno pleoptičkim i ortoptičkim metodama učvrstiti željene senzorne kvalitete i ne dozvoliti nastajanje novih anomalija, uključujući ambliopiju i dvoslike (1, 4, 8).

ZAKLJUČAK

Strabizmi dječje dobi ili tropije su većinom konkomitantni. Osobitost su im motorna anomalija ili neparalelnost vidnih osi. Motorna anomalija vrlo brzo uzrokuje senzorne poremećaje: od anomalne korespondencije dviju retina do teške slabovidnosti, ali uzročnost ima dvosmjerni karakter. U podlozi su neurofiziološke disfunkcije viših moždanih struktura (u moždanom deblu i korteksu) ali i refrakcijske anomalije. Liječenje je dugotrajno i podrazumijeva liječenje i senzornih i motornih poremećaja optičkim pomagalima, ortopleoptičkim metodama i kirurškom korekcijom.

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Summary

CHILDHOOD TROPIAS

V. Lakoš-Krželj

Strabismus or tropias are terms for misalignment of the visual axes. Strabismus are didvided into paralytic (which appear in any age) and nonparalytic or concomitant strabismus which are described by appearance at childhood and can be found in 5-6% of total population. Strabismus are motoric and sensoric disorders because they appear during the development of vision, when retinocortical mechanism of adaptation are elastic and able to defend of diplopias and confusion, which are made by motoric disorders. Management can be long-lasting and it consist of pleoptic methods (occlusion, pleoptic excersises) for treatement of amblyopia and other sensoric complications, and orthoptic methods (glasses, occlusions, prismas) which rehabilitate and keep alignment of the visual axes. The surgery on the extraocular muscles is only one step in the treatement of strabismus. The strabismic child should be followed continually to control treatement of developemental disorders of visual function in anomalous sensor-motoric conditions which can be found in chilhood tropias. New methods which are appropriate to age of child and stage of treatement should be introduced.

Descriptors: CHILDHOOD TROPIAS, ESOTROPIA, EXOTROPIA, AMBLYOPIA

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1 CET POINT

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Orthoptic exercises: a forgotten art?

Mohammed Aftab Maqsud, MMedSci, MSc, BSc (Hons), ProfGCE

Orthoptic exercises were first described as early as 1855 and are guided training exercises which can be used to treat a number of binocular vision defects. These methods are at risk of becoming a lost art as both orthoptists and optometrists take on extended roles, which are more diagnostic and less therapeutic, leaving less focus on binocular vision. However, many patients present to optometric practice with symptoms and signs of binocular vision anomalies and as such orthoptic exercises can be an area of great interest, but is an area which needs commitment from both practitioner and patient to be successful.[1,2] The scope of this article is to provide an introduction to the types of binocular vision conditions which are likely to be encountered in a primary care setting.

Course code C-30856 | Deadline: May 3, 2013

General Optical Council
Approved CET For Optometrists

Learning objectives

Understand the management of patients with an anomaly of binocular vision (Group 8.1.2)

Investigate and manage adult patients presenting with heterophoria (Group 8.1.3)

BINOCULAR VISION

General Optical Council
Approved CET For Dispensing Opticians

Learning objectives

Understand the investigation and management of patients presenting with anomalies of binocular vision, including the relevance of history and the recognition of any clinical symptoms (Group 7.1.5)

REFRACTIVE MANAGEMENT

About the author

Mohammed Maqsud qualified as an orthoptist having studied at the University of Liverpool in 2002. He is currently the acting deputy head orthoptist at Hull and East Yorkshire Hospital NHS Trust and a Clinical Demonstrator at Aston University teaching and supervising in binocular vision and paediatrics clinics. He has postgraduate Masters degrees in Managing in Health and Social Care (MSc) and Vision and Strabismus (MMedSci).

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1 CET POINT

Who should carry out orthoptic exercises?

Orthoptic exercises have been the realm of orthoptists for many years. Within the UK, hospital eye care services (HES) are well established and referral to such local clinics remains the first course of action for practitioners faced with patients with binocular vision anomalies. For many patients, the first eye care professional they visit will be their local optometrist. If orthoptic exercises are required, patients may prefer to be managed in a primary care setting and, as such, optometrists should be well versed in at least the basics of managing simple binocular vision anomalies. Equally, there will be instances where patients will benefit from specialist orthoptic assessment and management instead, for example due to the complexity of the problem or to enable regular review by the same person. Patient choice has been at the heart of consecutive government initiatives; the coalition government's approach aims to move away from a system where patients merely receive care to one where they are active participants in their care.[3] The focus of healthcare should be based on outcomes – an area likely to be given much greater focus following the publication of the Francis report.[4] Patients should have their treatment options clearly explained in order to allow them to make an informed choice with regards to their treatment. Part of this should include the option of referral to the local HES clinic for investigation and treatment by an orthoptist to which they are entitled.

Identifying patients who need orthoptic exercises

Patients with convergence or accommodation deficiencies, or binocular instability, typically attend complaining of similar symptoms. Symptoms are often caused by a failure of, or the need for significant effort from, the visual system in maintaining binocular single vision. Symptoms might include general asthenopia

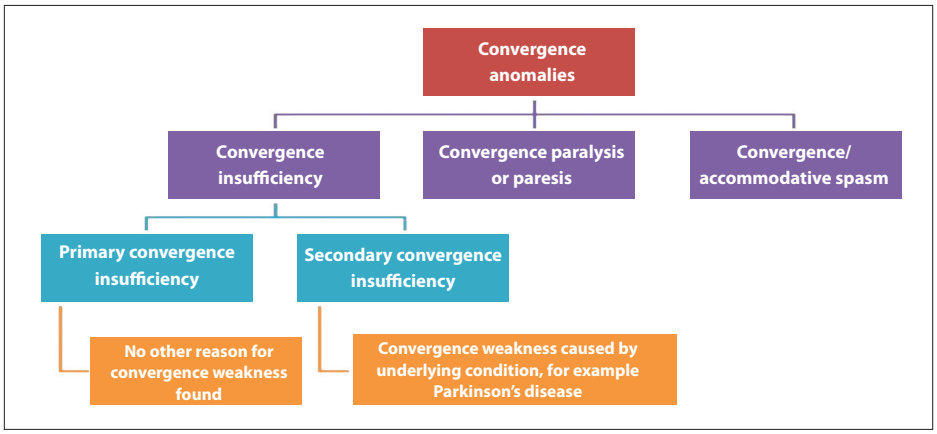

Figure 1 Classification of convergence anomalies

such as bilateral frontal headaches or eye strain, typically worsening at the end of the day or following a period of close work. Patients might complain of blurred vision or even intermittent diplopia too. Finding the trigger for the patient's symptoms can often aid in arriving at a correct diagnosis.[1,2,5,6]

Orthoptic exercises should only be considered if the practitioner is certain of binocular vision potential, thus being able to alleviate symptoms and certainly not exacerbate them. Where there is doubt in the primary care setting, referral to orthoptic secondary care is advisable. Furthermore, the practitioner must be confident that the patient is in good health and that there is no underlying secondary cause of the problem, which requires medical or specialist management. The patient must be motivated and have the ability and cooperation to carry out the exercises, for them to be beneficial. Accordingly, the patient will need to be able to attend regularly for review.

Risks of orthoptic exercises

Unfortunately, it is not unheard of for patients who have undergone vision therapy, specifically those relating to anti-suppression exercises, to develop insuperable diplopia. The likely cause of this is that practitioners have not taken the required precautions when selecting appropriate patients, which should be managed by orthoptic exercises. This is the biggest risk when using orthoptic exercises and it must be avoided. There is also a risk of causing accommodative or convergence spasm by overdoing the exercises or giving exercises to

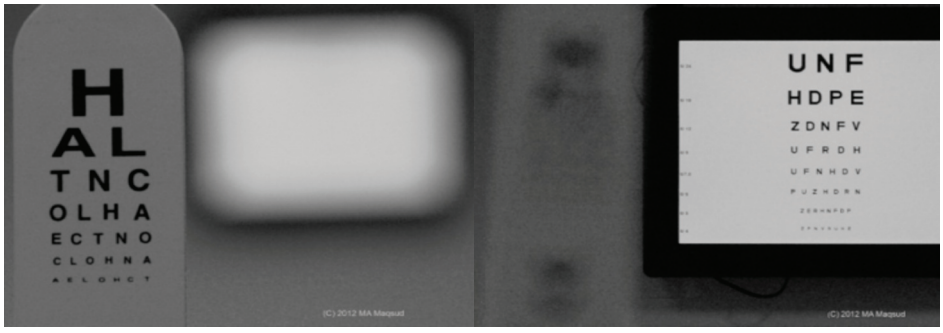

Figure 2 Targets used for jump convergence and jump accommodation exercises (see text for details)

Problem	Patient type	Likely symptoms	Clinical signs
Primary convergence insufficiency	Any age group Good health otherwise	Asthenopia Diplopia for near	Exophoria for near Reduced convergence Reduced base out fusional reserves
Secondary convergence insufficiency	Often elderly patients with significant health problems	Diplopia for near	Exophoria for near Reduced convergence Reduced base out fusional reserves
Primary convergence paresis or paralysis	Any age group with no significant history	Diplopia for near	Exophoria or exotropia for near. In paresis diplopia occurs at any distance less than infinity
Secondary convergence paresis or paralysis	Likely underlying neurological deficits May be secondary to head trauma	Diplopia for near	Exophoria or exotropia for near. In paresis diplopia occurs at any distance less than infinity
Convergence spasm	Young patients More likely to be female patients. May or may not have underlying organic cause	Diplopia and reduced visual acuity	Pseudomyopia Variable deviation exo. to eso. Pupil miosis Variable visual acuity

Table 1 Differential diagnosis of convergence anomalies[1,2]

inappropriate patients for example in patients with intermittent distance exotropia.[2]

Convergence anomalies

The classification of convergence anomalies is shown in Figure 1. All convergence anomalies are associated with asthenopia and diplopia at near with a relative exo deviation at near too. As such, the primary differential diagnosis of the type of convergence anomaly presenting needs to be made based on other features, as described in Table 1.

Clearly, it is important to reach the correct diagnosis before starting any treatment, as orthoptic exercises cannot be used to treat all convergence anomalies, an example being secondary convergence insufficiency where the underlying medical cause needs to be managed first. All patients at base line should have a refraction carried to ensure any refractive error is appropriately corrected before any orthoptic exercises are considered. In cases were convergence or accommodative spasm are suspected, a cycloplegic refraction should be carried out.[2]

Treating primary convergence insufficiency

Convergence insufficiency can be defined as a failure to converge to 6cm or patients who fail to reach 10cm comfortably and without fatigue. The exercises or combination of exercises used depends on the extent of the convergence insufficiency. Any exercises carried out should be done with optimum refractive correction.

The mantra used when prescribing these exercises is to do them 'little but often'; classically four to five minutes at a time and three times a day, ensuring relaxation following the period of exercise. Patients should be warned that symptoms are likely to get worse in the short term before they improve. Patients should be reviewed every two weeks if possible on the premise that, if the exercises have been done well, convergence will improve quickly. The exercises need to be modified as convergence and symptoms improve such that they are less intense and perhaps done less frequently; there is a risk of overdoing the exercises therefore close supervision is required.

Jump convergence

Two targets are required, one at near to be held by the patient and one at distance at least three metres away (Figure 2). The near target should be held close to the break point of convergence. The patient fixates on the near target ensuring binocular single vision then jumps to fixating on the distance target (for example a single letter on a VA chart if performed in the consulting room) ensuring it is single and kept clearly in focus. The patient should then jump back to fixating on the near target, again ensuring it is single and kept clearly in focus. At each distance the patient should maintain fixation with clear single vision for two to three seconds, and this should be repeated several times.

Simple pen-to-nose convergence

This is also known as pencil push-up, since the tip of a pencil or pen can be used; in practice patients are often asked to use a more detailed target such as a letter on a budgie stick instead. In either case, the patient holds the target at arm's length and while fixating on a certain aspect of this (pen/pencil tip or letter on a budgie stick), the target is steadily brought closer to the eyes, at a consistent speed. The patient must continue to fixate the target and attempt to maintain binocular single vision (Figure 3). If the patient reaches a point where single vision cannot be maintained, even with effort, the target should be slowly moved further away until single vision is achieved and then slowly moved closer once more trying to maintain single vision. At times, convergence will completely fail and the target should be taken back to the original position at arm's length and the process repeated. The patient should repeat this three to five times on average; however the exact instruction is dependent on what other exercises are also prescribed and the magnitude of the convergence insufficiency.

1 CET POINT

Figure 3 Near point of convergence and accommodative push-up exercises (see text for details)

Figure 4 Dot card for near point of convergence exercises (see text for details)

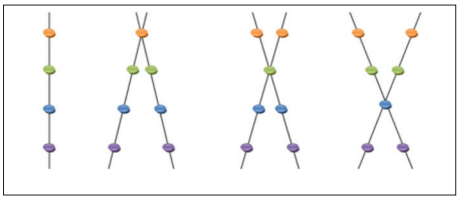

Figure 5 Brock strings for near point of convergence exercises (see text for details)

As such, it may be appropriate to advise the patient to do the exercises for one to two minutes, taking a five-second break between each cycle.

Dot card

The dot card comprises a slim rectangular piece of card with a single line in the middle; the line carries equally spaced dots at intervals along it. It is held below the patient's nose in a slightly depressed position (Figure 4). The patient fixates the furthest dot on the card and ensures that it is seen as a single dot. The patient then changes fixation to jump to the next dot along the line, closer to the eyes, ensuring it is kept single. The patient then changes fixation to jump to the next dot along the line and continues in this manner until they get to the nearest dot or until they reach a dot where single vision cannot be maintained, even with effort. In the latter situation, the patient should then begin the exercise again and repeat. Again three to five cycles are often appropriate, but the exact instruction is dependent on the combination of exercises given and the level of convergence insufficiency. A control for this exercise is ensuring physiological diplopia is perceived – that is, when the patient jumps fixation to a closer point on the card, all points closer and further than the one being fixated should be seen in diplopia. If this is not the case, the patient has suppression and the practitioner should be mindful of whether the exercise should be continued or not.

Brock string

This is similar to the dot card exercise. The patient will look at and jump between different coloured beads on a string (Figure 5). The patient begins by fixating on the furthest bead and then changes fixation to jump to the next bead along and continues in this manner until they get to the nearest bead or until they reach a bead where single vision cannot be maintained. Physiological diplopia will again be perceived.

Accommdative anomolies

The classification of accommodative anomalies is shown in Figure 6. The differential diagnosis is perhaps a little trickier as symptoms of the various types are the same and therefore the practitioner must look for other signs and perhaps elicit other information in the history for example recent trauma, as described in Table 2.

As with convergence insufficiency, all patients should have a refraction carried out – cycloplegic refraction being highly recommended – and any significant refractive error should be corrected before orthoptic exercises are considered.[2,7] In particular, this is important as a further indication for treatment with exercises, since some cases of accommodative anomalies will be as a result of significant latent hyperopia; if a low refractive error is found, it would be appropriate to carry out a cycloplegic assessment before prescribing the low refractive error. However, where symptoms persist despite correction of low refractive error, orthoptic exercises will be beneficial. The mantra used when prescribing these exercises is similar to convergence exercises; four to five minutes at a time, and three times a day, ensuring relaxation following the period of exercise. Patients should be reviewed every two weeks, and the exercises modified as accommodation and symptoms improve.

Treating accommodative insufficiency and fatigue

Accommodative insufficiency and fatigue are characterised by reduced amplitudes of accommodation in relation to the patient's age and signs of fatigue (further reduction of amplitude) on repeated testing. If this condition is suspected, it is important for the practitioner to ensure that there is no sign of

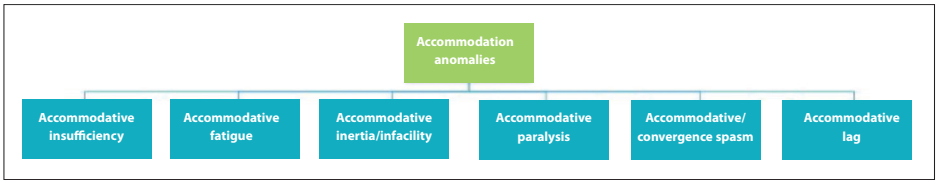

Figure 6 Classification of accommodative anomalies

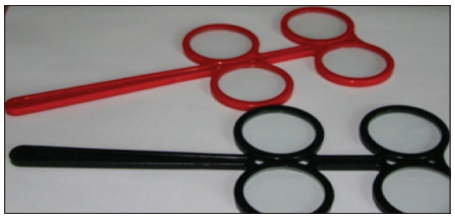

Figure 7 +2.00/-2.00 flippers for treating accommodative inertia (see text for details)

accommodative lag. To treat accommodative insufficiency or fatigue, the types of orthoptic exercises used are a combination of jump accommodation and accommodative push-ups.

Jump accommodation

This exercise is very similar to jump convergence described earlier. Essentially an accommodative target is used to fixate at two distances, one at near and one at distance (Figure 2). The patient is asked to alternately fixate between the two targets, in turn jumping from near to distance and back again. Although the near target should be placed at the closest point of blur to the patient, the exercise can be made more difficult by bringing the near target closer to this.

Accommodative push-ups

This exercise is similar to simple pen-to-nose convergence exercises described earlier, but with the use of an accommodative target such as a single word in a book. The target is held at arms-length and gradually brought closer to the eyes as the patient maintains this word in clear focus (Figure 3). This may be done monocularly or binocularly. When the patient reaches a point where the target cannot be kept in clear focus, even with effort, the target should be taken back to the starting position and the exercise repeated.

Treating accommodative inertia

Accommodative inertia or infacility is characterised by an inability to quickly change focus from distance to near and vice versa. This may be assessed using +2.00/-2.00 flipper lenses (Figure 7), whereby the patient views a near target through positive lenses, maintaining clarity of the target, and then the lenses are flipped to the negative ones requiring the patient to maintain clarity of the target through these; the number of repetitions/flips which can be performed in one minute is assessed (fewer repetitions are possible with accommodative infacility as more effort is needed for clear focus) and is reported as cycles per minute (cpm) completed. Reported values for norms are 8cpm binocularly and 13cpm monocularly in an adult population, but this can vary in younger patients[2,8] If fewer cycles are completed, the flippers can be used in this manner as an exercise to improve accommodative facility. Different lens powers can be given depending on the patient's ability. Accommodative infacility can also be exercised using jump accommodation, as described earlier.

Accommodative lag

It is beyond the scope of this article to describe the identification of accommodative lag, but the primary method for this is dynamic retinoscopy, which has been described in detail previously in *Optometry Today*.[9,10]

Decompensating heterophoria

Presentation

Decompensating heterophoria may present with intermittent diplopia and cover test is likely to show heterophoria at near or distance, dependent on the type of deviation, with a

Condition	Likely symptoms	Findings
Insufficiency	Asthenopic symptoms Blurred near vision	Reduced amplitude of accommodation for age May have esophoria for near Secondary convergence insufficiency
Fatigue	Asthenopic symptoms Blurred near vision especially following prolonged near work	Reduced amplitude of accommodation for age May have esophoria for near Secondary convergence insufficiency
Innertia	Blurred near and distance vision Can take time for vision to clear when looking from one distance to another	Can have normal or reduced amplitude of accommodation Poor accommodative facility
Paralysis	Blurred vision closer than infinity May be caused by trauma or underlying neurological conditions	Reduced near vision No measurable amplitude of accommodation
Lag	Asthenopic symptoms Blurred near vision	Reduced amplitude of accommodation Alleviated by low hyperopic correction
Spasm	Diplopia Reduced visual acuity	Pseudomyopia Variable deviation exo. to eso. Pupil miosis Variable visual acuity

Table 2 Differential diagnosis of accommodative anomalies

1 CET POINT

poor or delayed recovery. Furthermore, poor fusional reserves may be found, with weak levels of stereoacuity. The patient's monocular VA may outstrip their binocular VA and often patients report their vision is better with one eye covered than with both eyes open.[2] Orthoptic exercises are based around increasing either the fusional amplitudes or relative fusional vergence.

When to consider exercises

It is important to understand that it may not always be appropriate or possible to use orthoptic exercises to improve control of hetrophoria. It some circumstances, it may ultimately do harm in attempting orthoptic exercises in cases where surgery is required. A general rule would be to only consider orthoptic exercises in those with deviations measuring less than 15Δ.[2]

Fusional amplitudes

Clinically, a patient's fusional amplitudes may be improved using a prism bar. Positive fusional amplitudes may be improved by practicing the prism base out range, whereby the patient slowly increases the base out prism strength, while maintaining binocular single vision on a distance (distance decompensating exophoria) or near (near decompensating exophoria) target. If fusion breaks (diplopia occurs), the patient is told to try to regain single vision. If they are unable to do so, the prism strength is reduced until they are able to regain single vision. This is repeated three to five times in order to exercise and increase the fusional amplitude. For esophoric devations, negative fusional amplitudes are exercised and increased by using base in prisms.

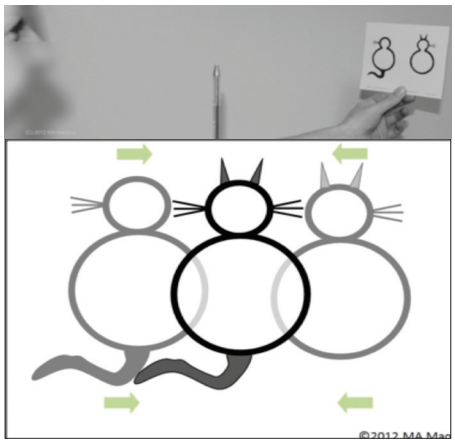

Figure 8 Stereograms for exercising fusional reserves (see text for details)

Relative fusional vergence

The aim of these exercises is to manipulate the amount of convergence exerted relative to the amount of accommodation exerted. This is predetermined by an individual's AC/A ratio, but the amount of convergence may be increased or decreased if the amount of accommodation is constant. This is most often done by the use of stereograms (Figure 8).

For exophoric deviations, the positive relative convergence is exercised and increased. For this, the amount of convergence for a given amount of accommodation is increased. This may be achieved by carrying out near stereograms whereby the patient fixates on a near target while attempting to fuse a stereogram behind it. For esophoric deviations, the negative relative convergence is exercised and increased. For this, the amount of convergence for a given amount of accommodation is decreased. This may be achieved by carrying out distance stereograms whereby the patient fixates at distance while trying to fuse a stereogram held at near.

Summary

In order to be successful with orthoptic exercises a number of criteria need to be met:

1. Correct diagnosis and appropriate selection of patients
2. A motivated patient
3. Management of patient expectations
4. Clear goals and targets
5. Clear and concise instructions
6. Regular review.

Only some of the exercises which can be prescribed have been described in this article, and practitioners need to remember that, where patients do not respond to in-practice treatment, onward referral to HES for orthoptic assessment should be considered. Remember, patients should be allowed to make an informed choice about who treats them and how exercises are to be carried out, as potential for success is based on a patient's commitment.

MORE INFORMATION

References Visit **www.optometry.co.uk/clinical**, click on the article title and then on 'references' to download.

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